4.2 NEUTRINO BEAM DEVICES (WBS 1.1.2)

4.2.1 Target Hall Devices Overview

The components included in the target hall devices (Figure 1 and Figure 2) are:

- Radiation shielding
- Baffle
- Target

Beam focusing horns, including field monitoring probes and a cross hair system to check the horn position with beam

Target/baffle carrier, which moves target to change neutrino beam energy

- Modules that carrier and horns are attached to, providing positioning and shielding
- Hot work cell, where broken components that are hanging from modules that are also radioactivated can be replaced
- Recirculating air cooling system for target pile
- Remote stripline connection for horns
- Instrumentation

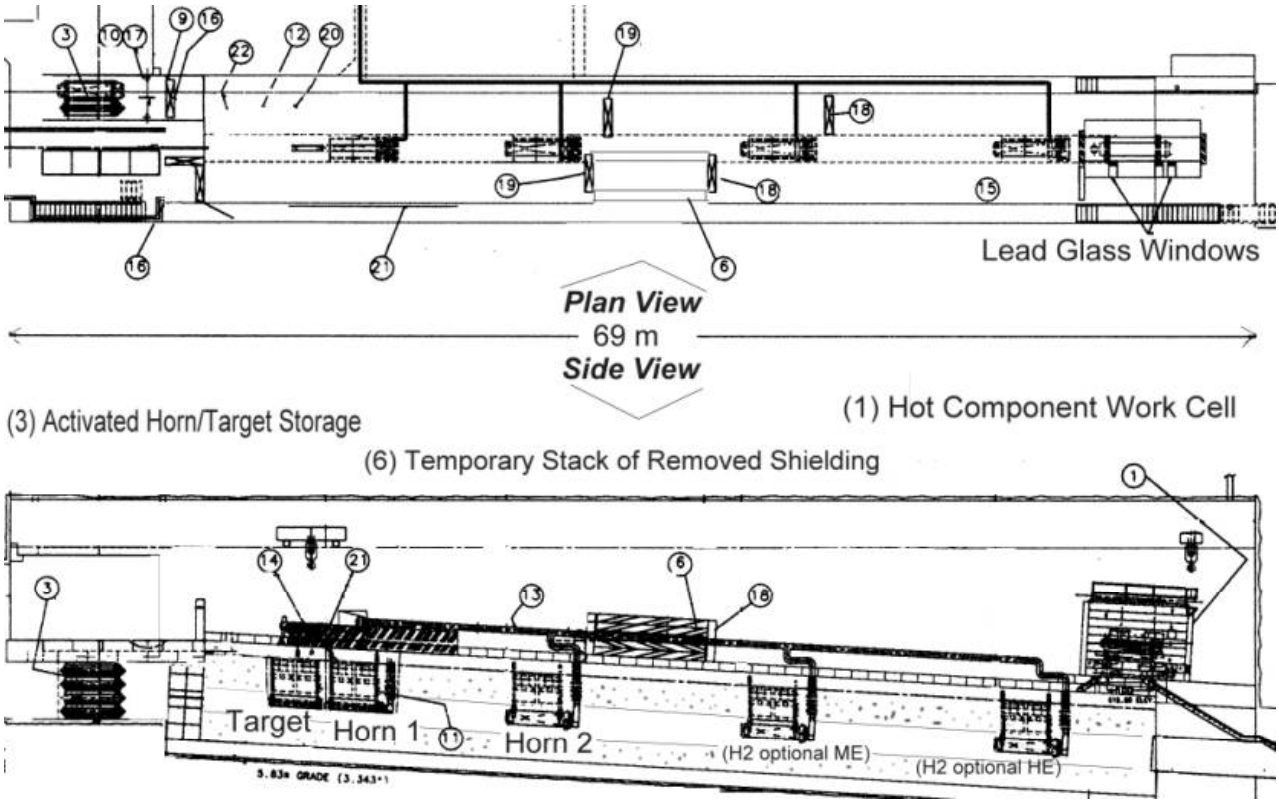

Figure 4.2-1 Plan and elevation views of the NuMI target hall.

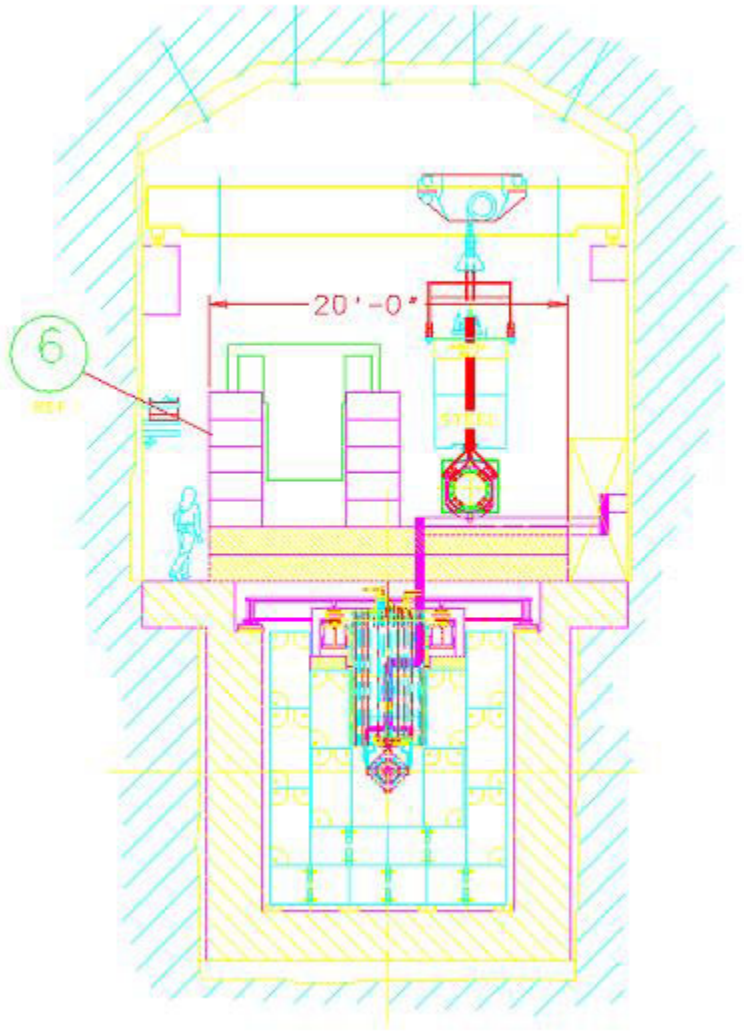

Figure 4.2-2 Cross sectional view of the NuMI target hall, showing a temporary stackup of removed shielding, and a module plus horn being transported.

Four coordinate systems are involved in the target hall design. LTCSZ and LTCSH are used by the surveyors for the overall NuMI layout. For the target hall layout drawings, it is convenient to use a third system, a Cartesian system where local gravity is vertical. The factor that drives the use of three coordinate systems instead of just one is that the curvature of the earth is significant over the length of the NuMI complex. The beam Monte Carlo is the fourth system.

The "Target Hall Drawing Coordinate System" is LTCSZ with a rotation (-62.18329 deg) about the z-axis such that the horizontal component of the neutrino beam is pointed along the drawing

y-axis. The vertical angle of the beam is –3.34349 deg. The beamsheet point DKINHL is taken as the (0,0,0) to anchor target hall drawings.

In the Monte Carlo coordinate system, the idealized start of horn 1 is (0,0,0), and the coordinate system is aligned with the beam. **Table 4.2-1** explains the relationship between beamsheet acronyms, physical devices, and the coordinate along the beam.

Beamsheet Nomenclature			MC coordinate L.E. beam
BAFL2P	**start of baffle**	**baffle is 150 cm long**	**-221.593cm**
HALTA1	**start of 1st half of target**	**leading edge of vertical fin; total target vertical fin is 95.38 cm long**	**-35 cm**
UPHRN1	*upstream-most edge of horn*	*start of curved end-bell of horn*	*-3.208 cm*
MCZERO	**Zero of GNUMI MC in target hall**	**where idealized horn 1 begins; middle of curved end bell of real horn**	**0 cm**
ACTRN1	**Horn 1 insertion point**	**start of real horn parabolic section; 3cm after start of 3 meter long idealized horn**	**3 cm**
HALTA2	**start of 2nd half of target fin**	**Focus point of the primary beam optics**	**12.69 cm**
DWNRN1	*extent of idealized horn 1*	*end of 3 meter long idealized horn 1*	*3 m*
UPHRN2	*upstream-most edge of horn*	*start of curved end-bell of horn*	*9.95202 m (9.955 m old)*
ACTRN2	**Horn 2 insertion point**	**also start of idealized horn 2**	**10 m**
DWNRN2	*extent of idealized horn 2*	*end of 3 meter long idealized horn 2*	*13 m*
DKINHL	**theoretical start of decay pipe, not including flange, window; also known as target hall endpoint**	**Used as zero for local cartesian coordinate system for target hall drawings**	**45.6982 m**

Table 4.2-1 Definitions of beamsheet terms, with relation to the Monte Carlo coordinate system along the beam direction.

Radiation dose to equipment is an integral design consideration, see **Figure 4.2-3** for a summary of radiation levels.

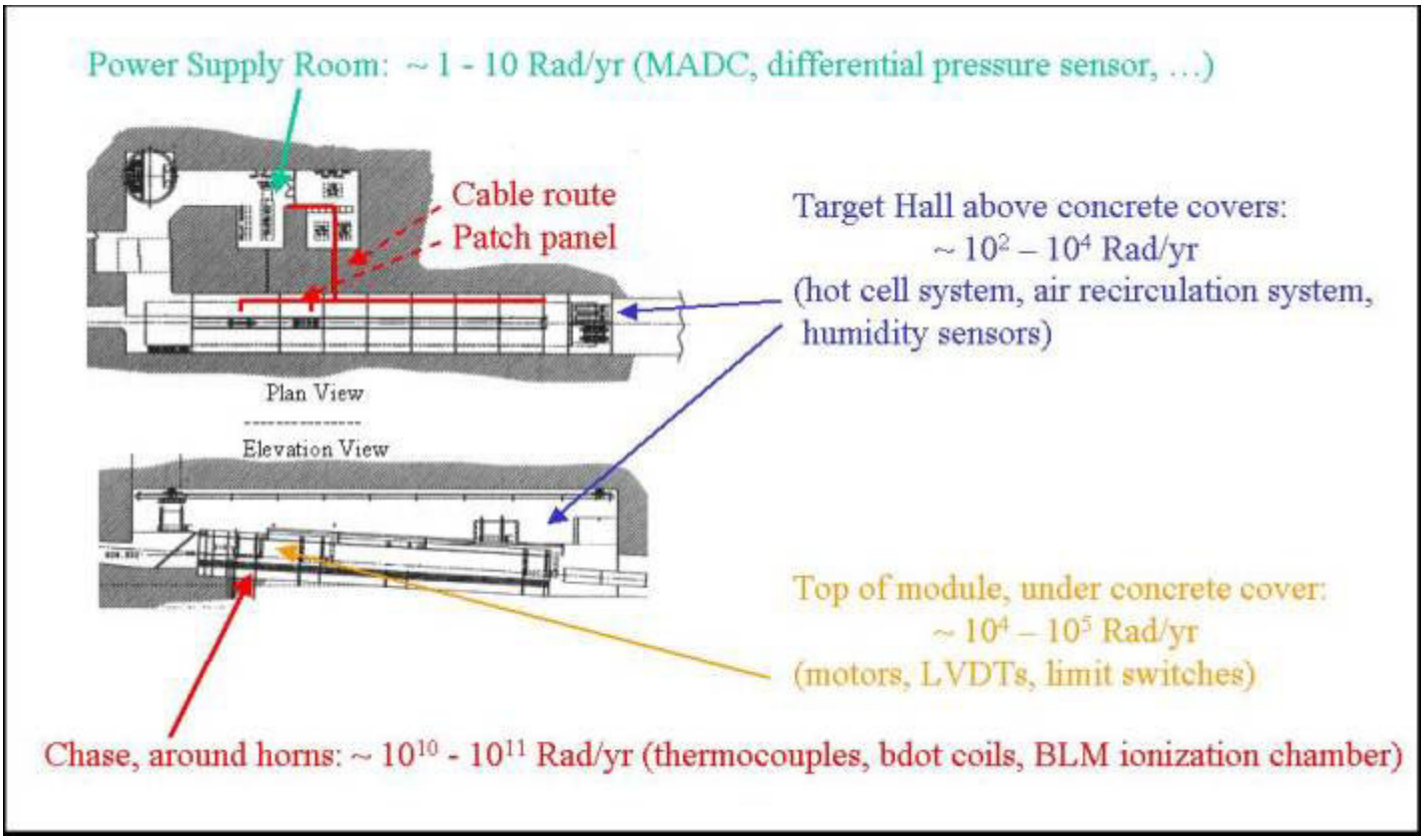

Figure 4.2-3 Overview of radiation levels in target hall.